



Safety Information Bulletin

CAAS SIB No.	2020-04
Issued	31 December 2020
Subject	Carriage of dry ice on aircraft to facilitate the transport of COVID-19 vaccines.
Ref. Publication(s)	<ol style="list-style-type: none"> 1) FAA Advisory Circular (AC) 91-76A - Hazard Associated with Sublimation of Solid Carbon Dioxide (Dry Ice) Aboard Aircraft; 2) FAA SAFO 20017 - Transportation of COVID-19 Vaccines Requiring Large Quantities of Dry Ice, 10 December 2020; 3) EASA – Transport of Vaccines Using Dry Ice, Issue No. 1, 17 December 2020; 4) ICAO Annex 6, Operations of Aircraft, Part I – International Commercial Air Transport – Aeroplanes; 5) ICAO Annex 18 – The Safe Transport of Dangerous Goods by Air; 6) ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air, Doc 9284; 7) IATA - Guidance for Vaccine and Pharmaceutical Logistics and Distribution, Edition 1, 16 November 2020.
Purpose	This SIB advises air operators on the carriage of dry ice on aircraft to facilitate the transport of COVID-19 vaccines.
Applicability	All air operators operating aircraft to or from Singapore.
Cancellation	This is the first issuance of this subject.
Description	<p>Some COVID-19 vaccines need to be kept at very low temperatures. Dry ice is used as a refrigerant to preserve such vaccines during transportation. Dry ice is often packed into insulated packaging containing vaccines, hence air operators transporting large volumes of COVID-19 vaccines on its aircraft may also need to transport large quantities of dry ice.</p> <p>Air operators should be aware of the safety risk involving the transport of large quantities of dry ice on aircraft. During transportation, dry ice sublimates and produces carbon dioxide (CO₂) which contributes to the concentration of CO₂ within the confines of an aircraft. Increased levels of CO₂ in cabin air may cause health effects including drowsiness and increase in rate and depth of breathing which cause discomfort to passengers and crew. If uncontrolled, excessive concentration of CO₂ may also lead to incapacitation. Sublimation of large</p>

quantities of dry ice during transport on an aircraft will also result in the loss of weight in cargo at the position where they are loaded which may potentially lead to a shift in the centre of gravity of the aircraft.

Due to its hazardous characteristics, dry ice is classified as dangerous goods and its transport by air must be in compliance with the standards of ICAO Annex 18 and the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air (TI). ICAO TI specifies that:

- shippers of dry ice have to comply with packing, marking, labelling and documentation requirements;
- air operators accepting and transporting dry ice on its aircraft have to comply with acceptance and loading requirements;
- air operators have to provide dangerous goods information of dry ice transported on an aircraft to the pilot-in-command; and
- air operators should document the maximum quantity of dry ice permitted in each compartment of its aircraft in its operations manual and which should be approved by the State of the operator.

By complying with safety regulations and taking appropriate measures to mitigate safety risk to aircraft and its occupants, larger quantities of dry ice may be safely transported on aircraft to facilitate the global supply of COVID-19 vaccines.

Recommendation

When transporting large quantities of dry ice on its aircraft, air operators should consider the following:

1. Carriage limits of dry ice should be based on guidance from aircraft manufacturers, taking into consideration the rate of aircraft ventilation, sublimation rate of dry ice and the number of occupants carried in an aircraft;
2. Air operators should work with shippers of dry ice to accurately determine the sublimation rate of the dry ice offered by such shippers based on the thermal performance of its packaging;
3. Cargo containing dry ice should be distributed on an aircraft such that the weight lost due to sublimation of dry ice does not result in the centre of gravity (CG) of the aircraft exceeding its allowable CG flight envelope;
4. Cargo containing dry ice should be loaded in the cargo holds with temperature controls set to the lowest temperature to minimise the sublimation rate of dry ice;
5. Aircraft should be dispatched with serviceable air condition packs, auxiliary power unit (APU) and supplementary/emergency oxygen systems to enable effective ventilation of the aircraft during ground and flight operations and to mitigate any inflight emergency arising from the buildup of CO₂;
6. During flight, maximum air ventilation should be provided to prevent the buildup of CO₂ in the aircraft;
7. During flight planning, air operators should consider aircraft diversion scenarios so that, in the event of an inflight emergency involving the buildup of CO₂, the flight crew have suitable alternates available to make a diversion;

8. Air operators should provide a means for crew members to monitor the CO₂ concentration on its aircraft by using CO₂ sensors installed on the aircraft or carried by crew members;
9. Crew members should be trained to recognise symptoms associated with high concentration of CO₂ in cabin air and to mitigate it, including the use of supplementary/emergency oxygen (and to note that reduced cabin pressure will draw CO₂ from the packages into the cabin);
10. Prior to unloading, ground staff should ventilate cargo compartments containing large quantities of dry ice by opening the cargo doors and allowing ambient air into the compartments;

Singapore Air Operators

Singapore air operators who wish to transport dry ice beyond the quantities specified in its operations manual approved by CAAS must seek prior approval from CAAS. In its application, Singapore air operators should provide:

- the basis for increasing the carriage limits of dry ice on its aircraft, which should be aligned with guidance from aircraft manufacturers;
- procedures, including operational controls and redundancies, to be included in its operations manual to implement the increase in carriage limits of dry ice and measures to ensure that these limits are not exceeded;
- revisions to applicable aircraft procedures, manuals or circulars relating to the transport of dry ice on its aircraft;
- information on training to be provided to crew members relating to the transport of large quantities of dry ice; and
- a safety risk assessment on the carriage of large quantities of dry ice on aircraft which should address the following hazards:
 - exceeding the carriage limits of dry ice on an aircraft;
 - accumulation of CO₂ in cabin air; and
 - loss of weight of cargo due to the sublimation of dry ice;

Foreign Air Operators

Foreign air operators should adhere to the dry ice carriage limits on aircraft as documented in its operations manual and approved by the civil aviation authority of its State. Foreign air operators who wish to transport dry ice beyond the quantities specified in its operations manual should seek guidance and approval from the civil aviation authority of its State.

Contact(s)

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